Constraining Middle Atmospheric Moisture in GEOS-5 Using EOS-MLS Observations
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Background
- Middle atmospheric water vapor plays an important role in climate and atmospheric chemistry.
- The Modern-Era Retrospective analysis for Research and Applications (MERRA) reanalysis did not assimilate any moisture observations in the middle atmosphere.
- Future GEOS-5 analyses will assimilate middle atmospheric moisture from Aura/MLS and other research satellites.

Middle atmospheric moisture in GEOS-5 analysis constrained by Aura/MLS observations

Monthly mean water vapor in GEOS-5 analysis and observed by MLS in the UTLS in Aug 2005 and Jan 2006

Annual moisture evolution in GEOS-5 analysis and MLS observations between May 2005 – April 2006

Summary
- GEOS-5 moisture analysis is improved by including MLS moisture observations in the upper stratosphere and mesosphere, and in the polar lower stratosphere.
- MLS data does not improve the moisture analysis in the tropical UTLS in current data assimilation system, which uses relative humidity as a control variable.
- To improve the moisture analysis in the UTLS, it is planned to use specific humidity as the control variable in the assimilation.

Aura/Microwave Limb Sounder (MLS)
- MLS is one of four instruments on Aura satellite, launched in July 2004. Aura is a part of polar-orbiting NASA “A-train” Earth Observation Satellite (EOS) constellation. MLS measures thermal emission at spectral bands centered near 118, 190, 240, 640 and 2250 GHz using a limb viewing geometry.
- MLS science data operations began 13 August 2004, and its products include temperature, moisture, cloud ice, ozone, and other chemical species between the upper troposphere and the mesosphere, with the top observation altitude varying with products (Livesey, et al., 2011).

Monthly variation of water vapor (ppmv) in GEOS-5 and observed by spaceborne ACE-FTS (Bernath et al., 2005) and (right) differences between GEOS-5 and ACE-FTS. GEOS-5 data are sampled at ACE-FTS observation locations.
- Atmospheric moisture field is improved in the mesosphere and lower stratosphere in GEOS-5 analysis.

Monthly variation of water vapor (ppmv) in GEOS-5 and observed by MLS in the UTLS in Aug 2005 and Jan 2006

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References